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ABSTRACT

Undergraduate education at Rensselaer Polytechnic Institute has been transformed by the campus-wide use of interactive learning and studio teaching. Rensselaer's 80/20 Model for interactive distance learning is a natural extension of its on-campus educational environment and will form the foundation for the future development of professional and distance education at the Institute. This paper provides an introduction to the evolution of the 80/20 Model, a description of the techniques, technologies and design strategies involved in developing the synchronous and asynchronous components of an 80/20 course, and an overview of implementation issues. Contains 14 references. (Author/AEF)

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Undergraduate education at Rensselaer Polytechnic Institute has been transformed by the campus-wide use of interactive learning and studio teaching. Rensselaer's 80/20 Model for interactive distance learning is a natural extension of its on-campus educational environment and will form the foundation for the future development of professional and distance education at the Institute. This paper provides an introduction to the evolution of the 80/20 Model, a description of the techniques, technologies and design strategies involved in developing the synchronous and asynchronous components of an 80/20 course, and an overview of implementation issues.

Introduction

Over the past decade Rensselaer Polytechnic Institute has transformed undergraduate education through campus-wide implementation of its innovative Studio teaching program. Studio courses are based on a foundation of interactive learning. Gradually Rensselaer has replaced large lecture halls with smaller studio classes where students are active creators of their own knowledge rather than passive receptacles of lecture delivered content (Wilson, 1994; Wilson, 1997; Jennings, 1998). Ongoing evaluation of both learning outcomes and costs have been very positive (Glinkowski, Hylan and Lister, 1997; Cummings et al., 1999) and the Institute continues to promote the growth and evolution of studio learning. This year alone Rensselaer has added 28 new studio classrooms designed for use with student-owned laptops and created new studio courses in computer science, math, engineering, economics, environmental sciences, and information technology.

While Rensselaer's on-campus learning environment has received national recognition and a number of awards, its distance learning program, RSVP, has also been highly successful, winning the General Motors Outstanding Partnership Award and the Best Distance Learning Program in Higher Education from the United States Distance Learning Association. Established in 1986, RSVP currently enrolls over 1000 students at 60 locations each semester in a diverse array of credit and non-credit courses. After several years of development, RSVP has recently adopted an interactive distance learning model that is a natural extension of Rensselaer's on-campus studio learning environment. This model, which we call the Rensselaer 80/20 Model, combines both asynchronous and synchronous learning and connects students, instructors and educational content in rich, online learning communities. In general, about 80% of a student's time would be spent on self-paced engagement of online materials and about 20% in interactive, synchronous learning sessions with the instructor and other students. These percentages are of course flexible and the optimal allocation of time to synchronous and asynchronous components, as discussed below, is a function of several variables including the nature of the course content, the age of the students, development costs, and faculty.

Evolution of the 80/20 Model

Lack of interaction has long been a drawback of traditional distance learning courses. Indeed, video-

based instruction via broadcast television or video tape essentially emulates the large lecture hall mode of instruction and suffers from a similar set of ills. Starting in the late 1970s and early 1980s, a number of researchers began to add asynchronous computer communications and synchronous interaction via two-way cable television and audiographics to traditional distance learning technologies. These studies indicated that interaction greatly enhanced education at a distance with improved attitudes, earlier completion of coursework, better performance on tests, and greater retention all cited as positive benefits (Baath, 1982; Kwiatek, 1982; Lister, 1988). Unfortunately, these early technologies were often extremely expensive and technically challenging to implement.

During the early 1990s, Rensselaer's Anderson Center for Innovation in Undergraduate Education pioneered the development of new methodologies for interactive distance learning. The Anderson Center, founded in 1990, serves as an incubator for curriculum reform by supporting faculty involvement in educational computing, developing new techniques and facilities for interactive learning, and sponsoring cutting edge research on the assessment of learning outcomes. In 1993, working with AT&T Bell Labs, the Anderson Center created and delivered an experimental IDL course for AT&T's University of Sales Excellence which emulated a studio classroom by connecting students in three states with their instructor through computer screen sharing and ISDN video (Wilson and Mosher, 1994).

The AT&T course formed the foundation for interactive distance learning at RPI and led to the development of the Internet-based teaching and tutoring system called LeanLinc which is now a commercial product sold by the LearnLinc Corporation in Troy, New York. In collaboration with the Anderson Center, RSVP produced the first IDL course at RPI using the LearnLinc software in 1997, *Survival Skills for Research Scientists*, taught by an RPI instructor to students at the City University of Hong Kong. That same year the Anderson Center also created two innovative courses for the National Technological University that were the first full implementations of the 80/20 model, *Hands-On Multimedia* and *Hands-On World Wide Web*. *Hands-On World Wide Web* attracted some 8000 students at over 500 sites in North America and Asia, an NTU record (Lister, 1998). During the past two years RSVP has also invested in a research and development program aimed at enriching the asynchronous component of the 80/20 model (Danchak et al., 1998). Based on the success of these pilot projects, RSVP has begun development of credit courses in the 80/20 format that will be offered to its corporate customers starting in the spring semester.

Synchronous Learning with the 80/20 Model

While the majority of a student's time is spent in asynchronous activities, the synchronous portion of an 80/20 course is crucially important. The learning outcomes and student retention rates in purely asynchronous, Web or CD-ROM-based courses are often disappointing for all age groups, but particularly so for younger learners. From its inception, the RPI 80/20 Model attempted to create "the social construct" of an interactive, face-to-face classroom and capture all the benefits of a hands-on learning environment (Wilson and Mosher, 1994). One the main technologies we are using to implement the synchronous portion of our 80/20 courses is the LearnLinc 3.1 software system for interactive distance learning.

A LearnLinc session begins with the students logging on to the LearnLinc server via Internet Explorer or Netscape (Figure 1). Once logged on, students are connected to each other and to the instructor in a virtual studio classroom. Depending on student location and available technology, the course might utilize LearnLinc's digital voice and video capabilities for communication, or video and voice over ISDN lines. Using LearnLinc, the instructor can employ several tools to emulate the proven techniques of interactive teaching that are so effective in the face-to-face classroom. The instructor might begin by asking if there are any questions on homework, reading assignments or group projects. As an aid to answering student questions, the instructor can activate the LearnLinc white board and share stored

graphics or solve analytic problems interactively by writing text and equations on the white board that appear on all of the student screens. The instructor can also bring up a Question and Answer tool that allows real time interactive quizzing and polling of the online students.

Following the format of a typical Studio class, the instructor might then present a brief mini-lecture on new content, sharing PowerPoint slides and multimedia, or using synchronized web-browsing to take the students to web-sites with course-related content. An extremely effective tool for interactive distance learning is the applications sharing feature of LearnLinc. Here the instructor can run any Windows-based software program on his or her machine and pass control over to any of the students. The students can then lead the class in running an interactive simulation or demonstration, or present a group project.

Asynchronous Learning with the 80/20 Model

By definition, the asynchronous portion of the Rensselaer 80/20 model is not coordinated in space or time. Students have always studied "on their own" but rarely have we attempted to put structure to this learning. We often tell them to "study chapter 10 and do problems 1 through 6", but little more. Should the asynchronous portion look more like the traditional classroom meeting or should it be more like the undirected independent studying students usually do?

As part of experimentation with the 80/20 model, we have tried, and are still trying, a number of approaches. One simple technique is to digitize the normal classroom activities and make them available on demand via streaming video. This updated version of videotaping may work well for some content and some students. Our goal of interactive distance learning answers this question with an emphatic yes! The other extreme, one that emulates independent study, may give the student a copy of slides used from an in-class presentation and tell them to go to it. Independence is valuable, but misses the input and feedback from instructor and other learners. Can we use this opportunity to do more?

It is not surprising that the most promising approach lies somewhere in the middle. What is very evident is that the structure and design of the asynchronous learning experience is crucial. We surveyed much of the learning literature and decided to combine techniques from instructional design, learning cycles, and distance learning (Gagne et al., 1992; Parker et al., 1996; Kolb, 1984). The result is shown in Figure 2. The components of Figure 2 are the "what", not the "how"! Content, student experience, and instructor preference may cause the "how" to vary, but the "what" should be constant.

The Interactive Distance Learning (IDL) Cycle starts with an introduction of the objectives and a statement of the necessary prerequisite material for this particular module. It strives to "humanize" the learning that is about to take place and make the student feel a part of a learning community. Following this motivational introduction, students are exposed to a concrete example (Concrete Experience) of what they are about to study (Step 2). Students are then asked to think about this experience (Reflective Observation) and share those thoughts with other students. Keep in mind, this is all done asynchronously. Step 4 (Abstract Conceptualization) presents principles or theories and requires feedback on performance. This is followed by an activity (Active Experimentation) that requires the student to go beyond regurgitating the content presented in Step 4. Finally, the student is prepared to transfer this new knowledge to future learning experiences.

This Cycle serves as a template for the asynchronous learning experience. Faculty can implement this cycle in any number of ways, depending on their individual circumstances. In working with various implementations, however, there seemed to still be something missing, particularly in the "humanizing" step. The learning modules lack personality. Among other things, we need to motivate students, orient them and give them direction. It has been shown that people seldom read a lot of text on the web. Hence,

we needed something more than text to add this personality.

Figure 3 illustrates how we added personality to web courses. In selected instances, we used streaming video in a second window, called the "Guide Window", to give the illusion of the instructor talking directly to the learner. The effect adds warmth to the learner's experience, actually demonstrated through usability testing. Video streaming is used at major transition points. Elsewhere in the module, streaming audio is used to provide direction to the learner as well as support and encouragement. Additionally, text is occasionally used remind the learner of key elements without being intrusive.

The IDL Cycle represents the only real constant in our 80/20 Model. Implementation will vary greatly, provided the structure of the Cycle is accounted for. Two things we have definitely learned: there is no single way to implement the Cycle and asynchronous learning is not for everyone. Much depends on the learner's maturity and motivation. Students must know what to expect prior to enrolling in an asynchronous course. One aspect we have added is a "test-drive learning module". This gives prospective students an opportunity to "try before they buy" an asynchronous course.

Implementation Issues

In the implementation of the 80/20 Model RSVP has looked at two different issues relative to its existing program. First, does the support infrastructure that currently exists for traditional video-based courses work for 80/20? Second, how do we transition traditional video-based courses to the 80/20 Model?

Providing a robust support infrastructure is not new for RSVP and has consistently been a strong focus throughout its twelve-year existence. Using that as a basis, RSVP has tried to identify the support needs of the 80/20 Model. To date they include marketing and promotion, academic student services, comprehensive course websites, technical support for students, and enhanced course development support, including instructional design support and the use of a team approach to course development. Each support function and the infrastructure or services provided by RSVP is described below.

The web is quickly becoming the primary marketing/promotion tool for RSVP courses and degree/certificate programs. The RSVP website includes detailed program descriptions for each degree or certificate program and captures inquiries which are fed into a database for tracking and automatic response to potential students.

RSVP student services have historically been provided in the form of professional staff who act as the liaison or interface to the Rensselaer campus for the distance students and site coordinators. In the 80/20 model, most student services will be provided via the web. On-line student services include downloadable forms for admissions, transfer credit, and degree clearance, on-line registration, 24 hour on-line access to individual student, registration and billing information, and on-line access to update individual contact information.

Each RSVP course has a comprehensive website that includes the following components: syllabus, faculty & TA contact information, course calendar, course notes, on-line quizzes/exams, homework assignments, links to other course content, bulletin boards for asynchronous discussions, and videostreamed lectures where they exist. In the case of the 80/20 Model, where most of the course will be delivered asynchronously, the course web-site becomes the hub of activity for the course and is critical to its success. RSVP staff work with course faculty to set up the website and also provide media development support in the form of web material development, multimedia application development and digital audio/video production and editing.

Individual technical support for the 80/20 Model must be easily accessible and will be provided primarily via the web. For RSVP, potential students as well as currently enrolled students have on-line access to information about technical requirements for participation in RSVP courses as well as phone and email options for getting help with technical problems they encounter. It is also possible for a student to do a live certification of a technical connection over the phone.

A key component to the infrastructure needed for the 80/20 Model is a team approach to course development. This requires a paradigm shift from planning to support the delivery of a distance course to designing and developing a course for delivery via the web in a the 80/20 Model. At RSVP the "team" will include the content expert, an instructional designer, an instructional technologist, a media developer, an administrative contact, and an evaluation specialist. Depending on the course and faculty, it may make sense to have a project manager who is responsible for coordinating the different aspects of the course development cycle and ensuring effective communication between all the members of the team. This approach is modeled after the Design Component of Moore and Kearley's Components of a Distance Education System (Moore & Kearsley, 1996) and is being piloted by RSVP for a new course being delivered in the 80/20 Model in the Spring 2000 semester.

Given the IDL cycle, a critical piece of course development is instructional design expertise. For the shift to web-based delivery and to consciously promote interactivity similar to that achieved in Rensselaer's Studio Teaching Model (Wilson, 1994; Wilson, 1997; Jennings, 1998), it is important to ensure a sound instructional approach based in theory and proven concepts. We believe this is what will distinguish Rensselaer from other web-based distance learning providers. To realize this goal, however, we will need to provide IDL instructors with the support and guidance necessary to implement the cycle in online content.

RSVP courses have traditionally been delivered via satellite broadcast, interactive videoconferencing, and mailed videotapes. As stated above, satellite and videotape delivery are not generally very interactive. Videoconferencing, however, tends to be a more interactive delivery mode and is encouraged whenever possible. For the past several years, RSVP has encouraged more interactivity in RSVP courses, both synchronously and asynchronously, through the use of email, chat rooms, audioconferencing via the web, telephone conferencing, videoconferencing as a supplement to regular class lectures, and asynchronous bulletin boards for asynchronous discussions between students and with faculty. Most recently, RSVP has successfully piloted the delivery of courses solely on the web with comprehensive course web sites, which include videostreamed lectures, supplementary course content and options for synchronous and asynchronous interactivity. All of these steps are helping to transition traditional video-based courses to the 80/20 Model via web delivery.

Conclusions

In this brief overview of the 80/20 Model we have necessarily left out a wealth of detail. As a final point, however, we want to stress that the 80/20 proportions described in this paper lie on a sliding scale of possible allocations of time to asynchronous vs. synchronous learning. The optimal apportionment of time will depend to a large degree on both course material and the student population. In general, we strongly believe that real time, synchronous interaction is of central importance in most distance learning courses and that implementation of the IDL cycle in the development of asynchronous content is the foundation of effective online learning. Regardless of student age or the particular subject matter for a given course, interaction with instructors and computer-based content promotes improved learning outcomes at a distance just as it does in face-to-face classrooms. The synchronous sessions also help keep students on track with course deadlines, help build teams and community, allow students to receive immediate feedback, and improve retention rates.

In the future, increased bandwidth will undoubtedly permit increasingly realistic emulation of face-to-face classrooms. Advances in networks, tools and techniques will allow ever greater functionality in the design and delivery of IDL courses, improving both synchronous and asynchronous learning experiences. At this point in the continuing evolution of interactive distance learning, implementation of the 80/20 Model through thoughtful use of existing tools such as LearnLinc, careful application of the IDL cycle, and attention to support and implementation issues, can greatly enrich web-based courses and significantly enhance online learning for off-campus students.

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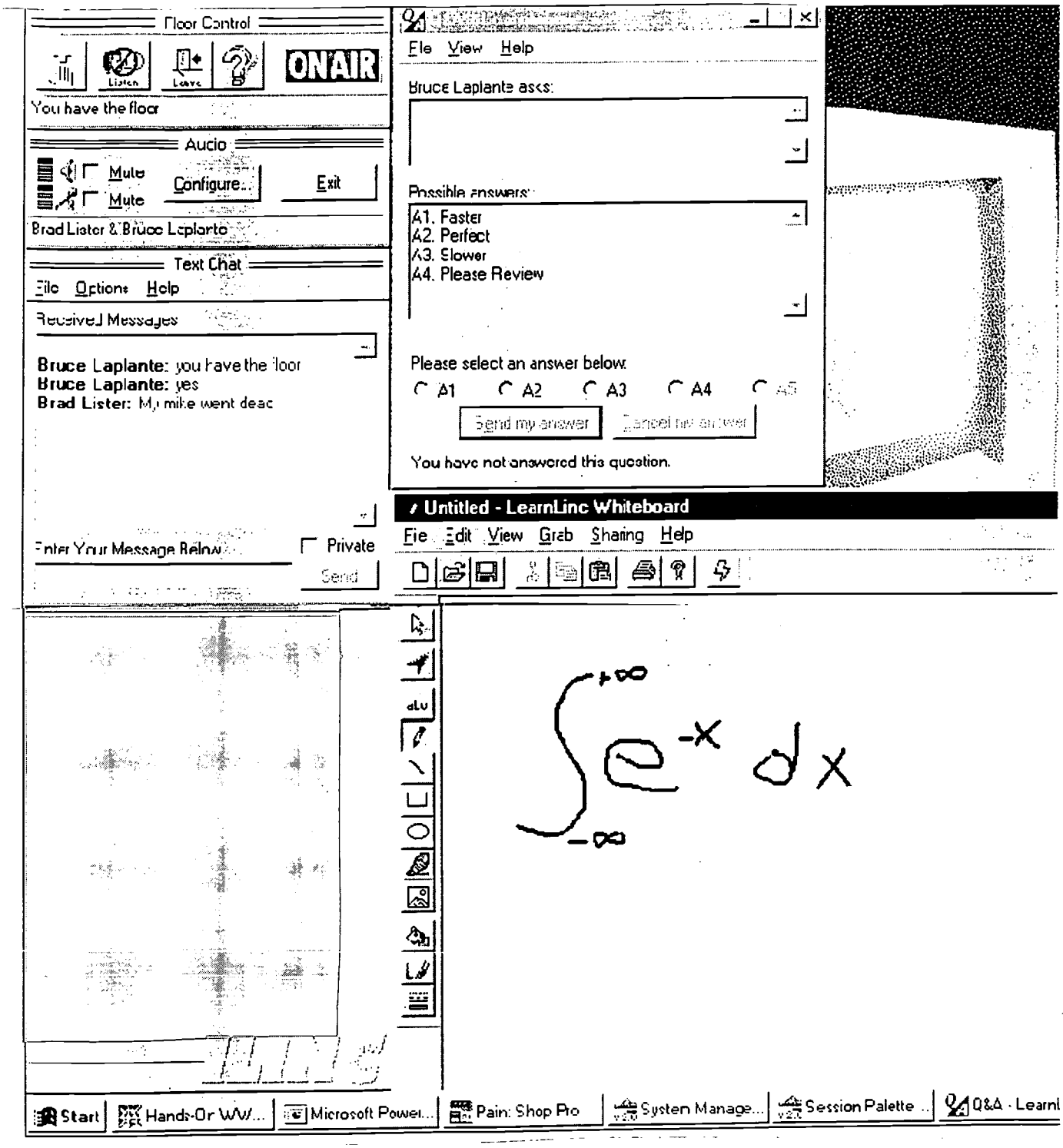

Figure 1. The LearnLinc student interface. Students can send private or public text messages to the instructor as seen on the left hand side of the screen. The instructor can also bring up the white board and share text and graphics with the students. At the top right is the Q&A tool for real time student polling and quizzing. Other LearnLinc tools include synchronized web browsing, applications sharing and the ability to capture and present student computer screens.

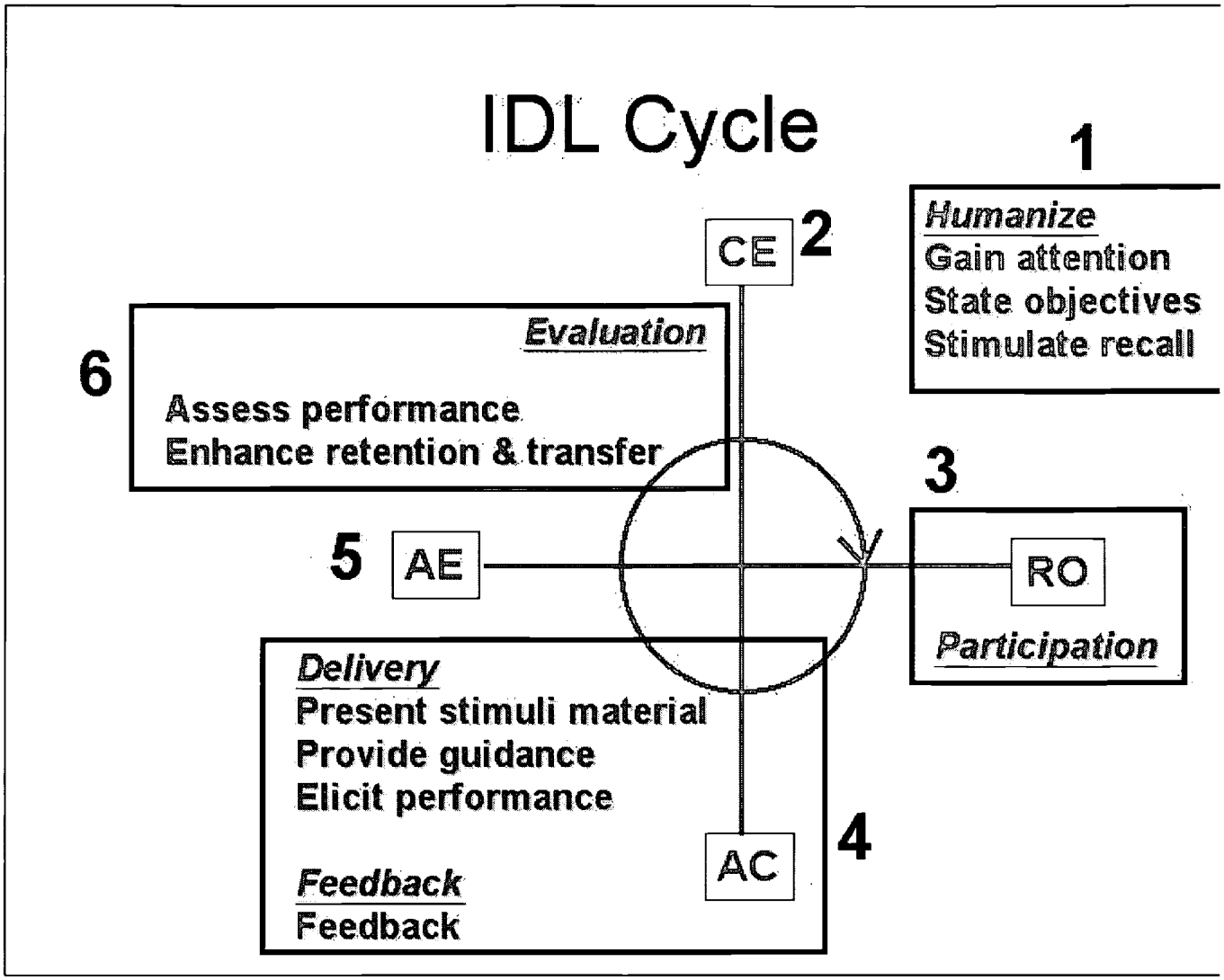

Figure 2. Interactive Distance Learning Cycle that combines a variety of concepts. This cycle combines concepts from instructional design, distance learning and learning styles. The steps represent "What" must be done. It is up to the instructor to choose "How".

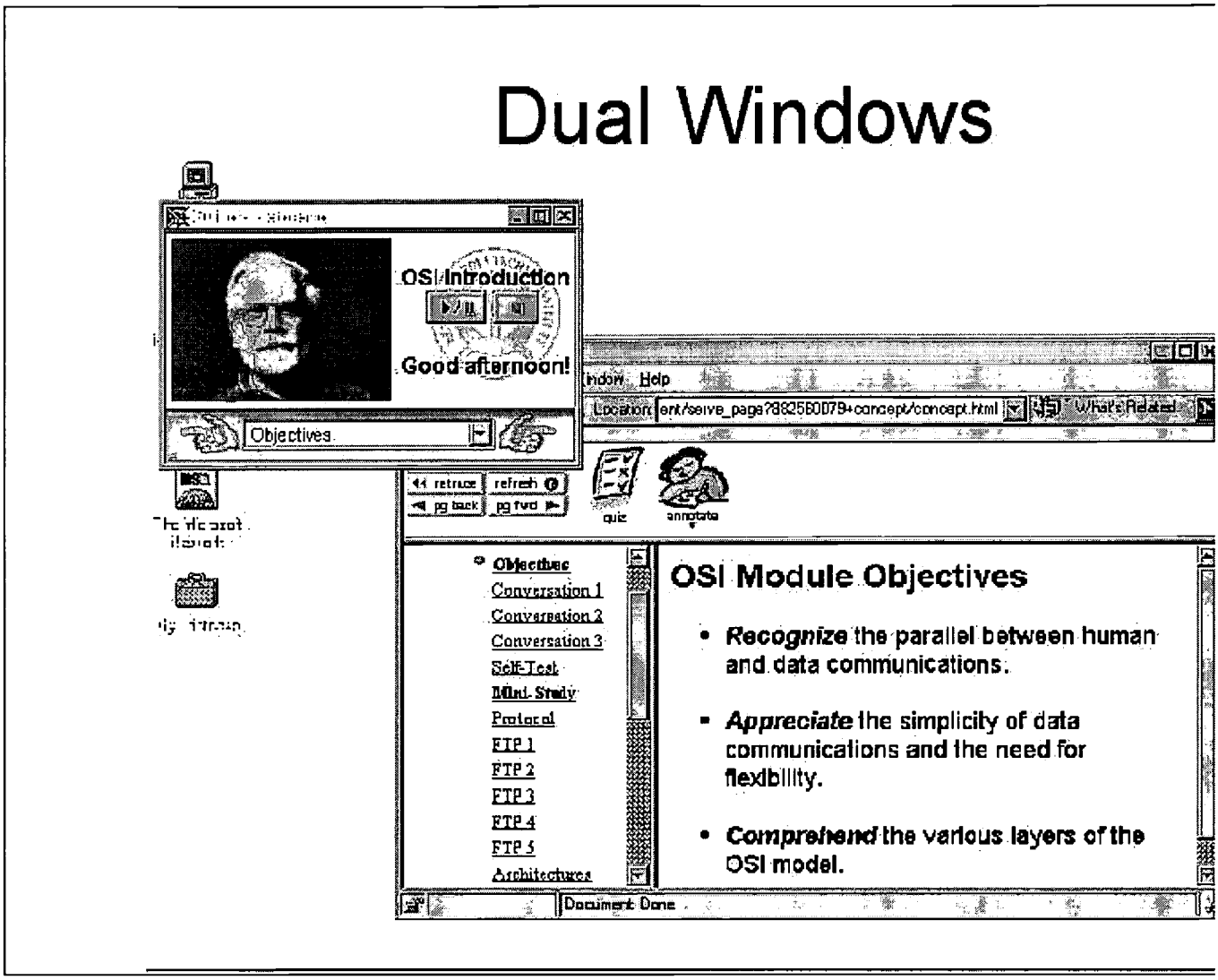

Figure 3. Addition of a personality in a new window that complements the contents. This "Guide" Window uses video streaming, audio streaming and text to emulate an instructor's function. However, it does not lecture.

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